Chapter 6
CONCLUSION

The reactor model used in the simulation code has proved to be acceptable both in its ease of implementation and the accuracy of calculations. Increasing the number of core nodes by more than 10 did not improve the calculation results considerably but slowed down the code running speed significantly.

The dynamic results obtained are in good agreement with the experimental observations. It can be seen that at full power the margins to ONB and DNB are about 1.3 and 4 respectively, well within the allowable margin for pool-type research reactors. However, if the coolant temperature at the core inlet is greater than 30°C, the maximum cladding temperature will exceed the accepted aluminium corrosion limit of 105°C.

Modifying the friction resistance coefficients calculated theoretically at the core inlet and outlet by a factor of 10 resulted in steady-state core flows that compared well with the values determined experimentally at power levels from 10 to 100%.

Several postulated reactivity transients have been studied and it was shown that without the reactor protection system working, the core is unlikely to withstand the accidents caused by the insertion of 1$ (β_{eff}) or more, because of the very small negative temperature reactivity feedback coefficient. Inherent to such overpower accidents, however, is extensive void formation with large negative reactivity feedback. As void formation, post-nucleate boiling and two-phase flow effects in general are not covered in this work, the code cannot predict the reactor dynamics whenever boiling occurs and thus conclusions on the consequences of such accidents cannot be offered.

As the investigated transient time is from several milliseconds to tens of minutes, with the exception of neutron flux amplitude, all neutronic parameters such as neutron distribution, effective delayed fraction, temperature reactivity coefficients, etc. are considered constant during a transient. However, these parameters should be updated with the fuel burn-up after long time operation or when the core composition is changed.

For future work, heat transfer with boiling and two-phase flow regime should be studied and included in order to extend the use of the code to the more accurate analysis of severe accidents. Also, the solution to hydraulic dynamics should be improved in terms of the time step size to improve the performance of the code.